

# MET-2270: ADVANCED ROBOTIC WELDING/ARC TOOL

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## Cuyahoga Community College

### Viewing: MET-2270 : Advanced Robotic Welding/Arc Tool

#### Justification for this deactivation request

This is exactly the same course as ISET 2151 robotic welding. this course is not tied to any certificate or degree where ISET2151 is so this course should be deactivated

#### Board of Trustees:

January 2023

#### Academic Term:

Summer 2023

#### Subject Code

MET - Mech Eng/Manuf Ind Eng Tech

#### Course Number:

2270

#### Title:

Advanced Robotic Welding/Arc Tool

#### Catalog Description:

Course provides preparation to sit for the Arc Tool Certification test. Covers powering up robots, safety procedures, using a teaching pendulum, mastering and calibrating the robot. Also includes setup, creating and editing weld programs of arc tool for specific weld applications.

#### Credit Hour(s):

3

#### Lecture Hour(s):

2

#### Lab Hour(s):

3

## Requisites

#### Prerequisite and Corequisite

ISET-1101 Welding Blue Print Reading or departmental approval.

## Outcomes

#### Course Outcome(s):

Safely power up the robot from a complete shutdown.

#### Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

#### Objective(s):

- a. Inspect the robot and surrounding area.
- b. Advise other workers of the startup to avoid the possibility of injury.
- c. Study and use the manufacturer's startup procedure.

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#### Course Outcome(s):

Manipulate the robot using a teaching pendulum

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Explain the purpose of pendant-based robot programming.
- b. Demonstrate using the pendant in 'learn' mode.
- c. Demonstrate saving to file the results of pendant learning.
- d. Edit the file relating to pendant-based learning.

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**Course Outcome(s):**

Setup and test the robot movement parameters for a given work cell and torch.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Identify the torch that is specified for this component of the job.
- b. Attach the torch to the robot.
- c. Review and explain the individual steps for the work cell.
- d. Make appropriate adjustments for movement parameters for the work cell.
- e. Test movement and torch operation.

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**Course Outcome(s):**

Setup the arc tool for specific weld applications.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Explain issues that lead to a bad weld for a type of metal
- b. Determine and explain the required temperature for the type of metal being welded
- c. Determine and explain the motion rate for the type of metal being welded
- d. Prove the understanding of the welding operation by making a good weld

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**Course Outcome(s):**

Create and test weld programs for a given weld task.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Demonstrate knowledge of the programming language's rule by programming without errors.
- b. Simulate the program by verifying the robot and program are performing as desired.
- c. Correct discrepancies between the simulation result and what is desired.

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**Course Outcome(s):**

Edit weld programs in 'teach' mode.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Develop a strategy to modify program component that do not produce the desired result(s).
- b. Edit the weld program and verify by simulation or operation.
- c. Save the modified program to file management system and follow the procedure for program version revision.

**Course Outcome(s):**

Manipulate Input/Output (I/O) in program logic and real logic.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Explain the difference between program logic and real logic.
- b. Explain the meaning of an I/O device.
- c. Name all I/O devices that are used by the robot.
- d. Demonstrate using I/O devices in accord with a predetermined task.
- e. Inspect I/O devices for wear or other anomalies that can produce deviations from the desired welding task.

**Course Outcome(s):**

Master and calibrate the robot

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Explain the various types of calibration that associate with the robot.
- b. Explain the various types of calibration that associate with I/O devices.
- c. Fill out various forms that indicate the details of calibration.
- d. Make the robot ready for use after calibration.
- e. Verify that calibration does not adversely affect the accuracy of the welding program.

**Course Outcome(s):**

Discuss and ascertain safety procedures are integrated into all training exercises.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

- a. Refer to the safety related component of the robot's manual of operation and explain the procedures where they apply.
- b. Explain any additional safety measure that are related to the business enterprise.
- c. Recommend safety procedures based upon the discovery of operation that poses a safety threat.
- d. Explain punitive actions can occur if safety procedures are not followed.
- e. Practice safety always when working with the robot including welding operations.
- f. Explain the properties of the type of metal.

**Methods of Evaluation:**

1. Tests/quizzes
2. Laboratory or task assignments
3. Homework

**Course Content Outline:**

- a. Power up the robot from a complete shutdown
  - a. Study the startup process
  - b. Work with team member in when executing startup
  - c. Inform management of any issues regarding startup
  - d. Check for obstacles that can interfere with robotic movement
  - e. Inspect the robot for hydraulic leaks
  - f. Inspect the power cable-to-robot connection
  - g. Follow safety procedures
    - I. Safety regarding other persons
    - II. Safety regarding other equipment
2. Using the teach pendant
  - a. advantages of a teach pendent relative to direct programming
  - b. Teaching pendant theory of operation
  - c. Correct mistakes in the tool path
    - I. Determine the degree of the error
    - II. Determine if the correction produces the desired result
  - c. Saving the teaching session
  - d. Invoking the teaching session for productive robot operation
3. Robot movement parameters for a given work cell and torch
  - a. Verify torch operation
  - b. Verify work cell contents
  - c. Test the work cell and torch operation together
  - d. Log the operation per policy
4. Arc Tool use for a specific weld applications
  - a. Select a task to verify the specific weld application
  - b. Determine the characteristic of the type of metal being welded
    - I. Welding temperature
    - II. Rate of torch movement
  - c. Inspect the weld
  - d. Verify safety procedures are being followed
5. Welding program(s) for a given task
  - a. Create a design document that outlines the sub tasks that are necessary for the job
  - b. Learn the program language syntax
  - c. Compile, observe and fix compiler error report(s)
  - d. Run an program simulation test
6. Edit weld programs
  - a. Determine if the currently executing program does not meet the deign specification for the job
  - b. Find the errors
  - c. Correct the errors
  - d. Test the modification(s)
7. Save robot and torch operations to management file devices
  - a. Use stated procedure to save the design file
  - b. Backup in case the file management device fails
  - c. Follow version control policies
8. Manipulate Input/output (I/O) in program logic and real logic
  - a. I/O devices that are need for a job
  - b. Specific I/O devices

- I. List I/O devices
- II. Check and test I/O devices
- c. Learning I/O operations
- d. Practicing I/O operations
- e. Use I/O operations in constructing the job design document
- 9. Mastering and calibration
  - a. The importance of calibration
  - b. The consequences of improper calibration
- 10. Safety procedures
  - a. Safety is importance
  - b. Consequences of an injury
    - 1) Personal suffering and possible loss of life
    - 2) Family suffering

### Skills

- 1. Analytical problem solving
- 2. Able to predict probable outcomes based upon faults
- 3. Attentive to the situation

### Resources

A. E. Bennett, Louis J. Sly. *Blueprint Reading for Welders*. 9th. Delmar, 2015.

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Cameron Hughes, Tracy Hughes. *Programming: A guide to Controlling Autonomous Robots*. 1st. Que Publishing, 2016.

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Larry Jeffus. *Welding, Principles and applications*. 8th. Delmar, 2017.

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Tarn Tzyh. *Robotic Welding, Intelligence and Automation: RWIA'2014*. 1st. Springer, 2015.

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William Galvery & Ryan Friedlinghaus. *The Art of Welding*. 1st. Industrial Press, Inc, 2013.

### Resources Other

- a. A. E. Bennett, Louis J. Sly. *Blueprint Reading for Welders*. 9th., Ed. Delmar, 2015.
- b. Cameron Hughes, Tracy Hughes. *Programming: A guide to Controlling Autonomous Robots*. 1st., Ed. Que Publishing, 2016.
- c. Larry Jeffus. *Welding, Principals and applications*. 8th., Ed. Delmar, 2017.
- d. Tarn Tzyh. *Robotic Welding, Intelligence and Automation:Rwia 2014*. 1st., Ed. Springer, 2015.
- e. William Galvery & Ryan Friedlinghaus. *The Art of Welding*. 1st., Ed. Industrial Press, inc., 2013.

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